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BLISTER RUST DAMAGE TO POLE-SIZED WESTERN WHITE PINE ON THE MIDDLE FORK OF THE ST. MARIES RIVER

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Title: BLISTER RUST DAMAGE TO POLE-SIZED WESTERN WHITE PINE ON THE MIDDLE FORK OF THE ST. MARIES RIVER

Purpose: To determine the probable extent of blister rust damage and the estimated future loss in a heavily infected pole-size stand of western white pine.

Summary: About 530 acres (in Section 10, T 42 N, R 2 E) of heavily infected pole-size pine on the Middle Fork of the St. Maries River was sampled by a line plot method. The stand is near even-age having resulted from a burn some 60 years ago, and is quite uniform as to density and stocking. Rust has been present on pine since 1929, the records showing that infection had increased from 10 per cent in 1930 to 41.5 per cent in 1937.

Estimation of rust damage (i.e. trees with actual or anticipated killing cankers) was made using data developed by MacLeod for the Inland Empire region.

On the area sampled trees of all species averaged 425 trees per acre and of these 166 were crop trees. Of the white pine crop trees 95 per cent were infected and 70 per cent had killing cankers. In 1967 this timber stand will probably contain some 16 white pine crop trees per acre and 4 additional replacements by intermediate white pines.

White pine heights are increasing from 2½ to 3 feet per year and diameters about 0.25 inches per year. Volume additions of white pine will exceed volume losses in this stand for only ten years if annual loss of crop trees approximates five per cent.

Spokane, Washington
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Introduction

A pole stand of western white pine located in Section 10, T 42 N, R 2 E, Boise Meridian, along the Middle Fork of the St. Maries River east of Clarkia, Idaho, was examined during the summer of 1946 to determine the probable extent of blister rust damage.[1/] Section 10 is centrally located in an old infection center, supports a representative mixed pole stand and is easily accessible by road. (Figure 1). The stand in question has been under constant surveillance since 1928 when the rust was first reported there on Ribes petiolare by Putnam (1). White pines along the river were known to be infected by 1929 (2) and their infection increased periodically thereafter -- 10 per cent in 1930 (3), 11.3 per cent in 1931 (4), 17.5 per cent in 1935 (5), and 41.5 per cent in 1937 (6). This rapidity of rust intensification on pines in this 1923 center has been attributed to the presence of highly susceptible R. petiolare (2, 3, 4 and 7).

Methods

A systematic line-plot method of sampling was employed which provided a 1 per cent sample of the 530 acres south of the road in Section 10. The stand is even-aged, resulting from a burn of some 60 years ago.

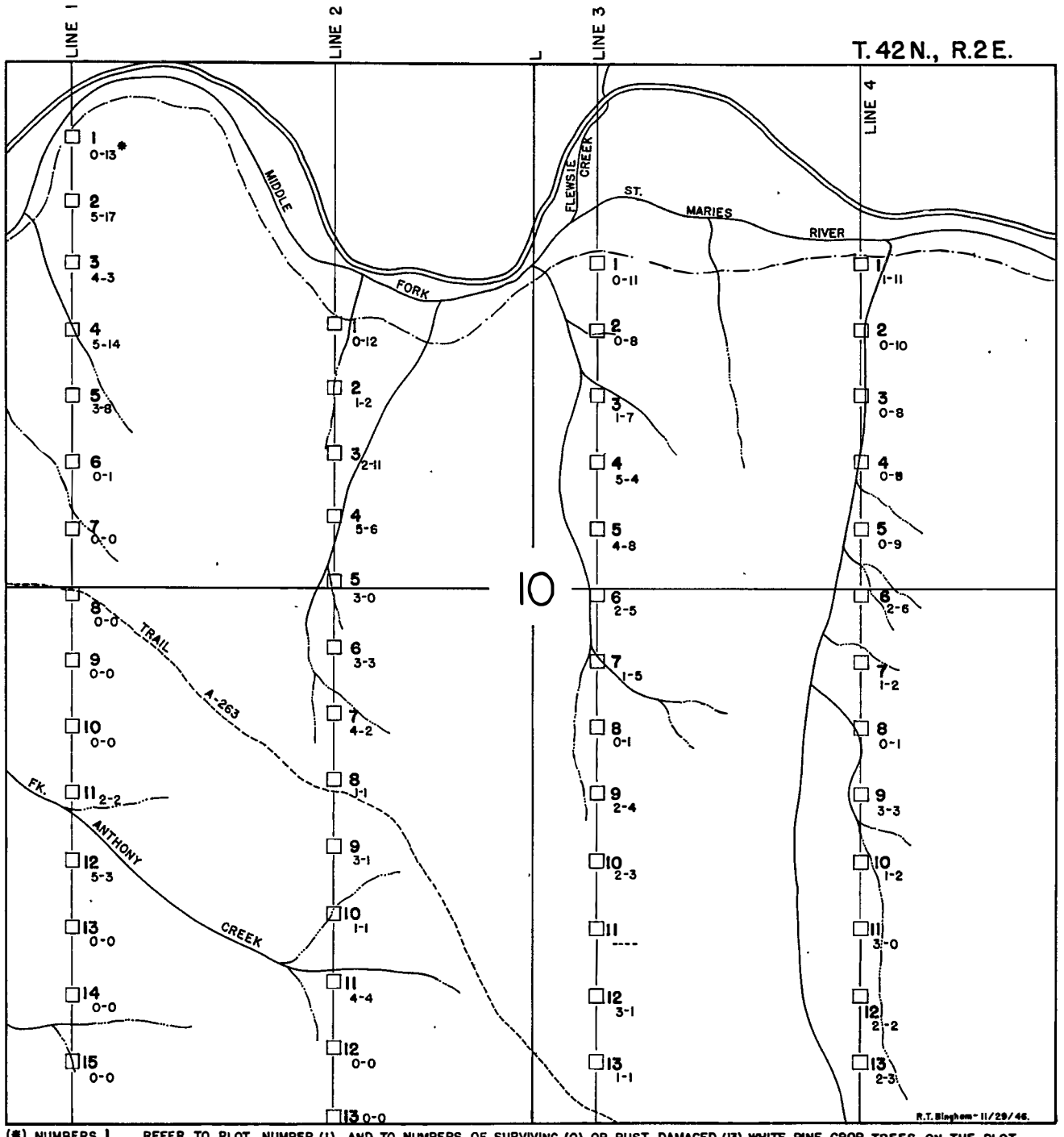
1/ Damage where used in this report means eventual loss due to blister rust infection.

It is quite uniform as to density and distribution of stocking, trees of several species being represented. Rust infection is uniformly intense along the lower slopes where white pine predominates. Arrangement of the square tenth-acre plots, 5 chains apart on parallel lines spaced at 20-chain intervals, can be seen in Figure 1.

Plots were examined as follows: (1) The square plot was laid in with string and the species, DBH, and dominance recorded for each tree over four inches DBH. (2) White pines were examined from the ground with binoculars to detect damaging blister rust trunk cankers. Unless killing cankers could be seen from the ground, trees were climbed and carefully inspected for undetected trunk cankers or for potentially damaging branch cankers. (3) Eventual loss in dominant and codominant white pine crop trees and the residual stand composition was estimated for the plot. On line 4, replacement of damaged white pine crop trees by intermediate white pines and by other intermediate trees was also considered.

Pines were considered damaged if they supported one or more trunk cankers or one or more branch cankers classed as potentially damaging. In judging branch cankers either as harmless or potentially damaging data obtained by R. L. MacLeod for the Inland Empire were employed. MacLeod measured linear growth toward trunk of more than 700 dead cankers. A condensation of these data was prepared showing average spread toward trunk to be expected of cankers on branches up to one inch in diameter:

Branch diameter (inches)	Average spread toward trunk (inches)
0 - $\frac{1}{4}$	6
$\frac{1}{4}$ - $\frac{1}{2}$	6
$\frac{1}{2}$ - 3/4	6
3/4 - 1	9



(*) NUMBERS 0-13 REFER TO PLOT NUMBER (1), AND TO NUMBERS OF SURVIVING (0) OR RUST DAMAGED (13) WHITE PINE CROP TREES ON THE PLOT.

FIGURE 1.

SECTION 10, SHOWING THE 54 ONE-TENTH ACRE SAMPLE PLOTS AS THEY WERE LAID OUT ON 4 LINES FOR THE POLE DAMAGE STUDY. NOTE HEAVY RUST DAMAGE ALONG THE RIVER AND THE POOR WHITE PINE STOCKING BETWEEN STREAMS ON THE RIDGES.

The above data were used except for cases where, during the average six or nine inch-spread the canker margin encroached over a node which provided a new food source in the form of green lateral branches. When this occurred the canker was judged capable of continued growth dependent on the diameter of the new internode into which it had extended.

This method of judging canker potentialities may be criticized on the grounds that it fails to consider the effects of total distance from canker to trunk, of natural suppression of cankered branches, of canker parasitism by secondary fungi and of canker gnawing by squirrels. It must be remembered, however, that MacLeod's data provide average growth for all types of dead cankers which have run the entire course of canker development from inception to death as influenced by their total distance from the trunk, by the suppression of supporting branches, and by the inroads of secondary fungi and rodents. The method also considers other basic factors controlling canker spread -- thickness of the bark as directly correlated with diameter of the cankered internode (8) and proximity of a new food supply for the obligate rust parasite once it has caused branch flagging and so cut off its own food supply from the rear.

Results and Discussion

Results of the damage study are shown in Table 1. On the 54 tenth-acre plots examined, a total of 2,292 trees over 4 inches DBH were recorded, about 425 trees of all species per acre. Of these 425 trees about 166 per acre were classified as dominant and codominant and will presumably be the crop trees at stand maturity.

TABLE 1. STRIP AND PLOT DATA ON PINE DAMAGE AND FINAL STAND COMPOSITION

Strip Number	Plot Number	Number Trees Over 4 inches D.B.H.	DOMINANT AND CODOMINANT TREES									Intermediate Trees	
			WPP Surviving	WPP Damaged	Total WPP	WL	DF	GF	WH	LPP	Other	WPP Surviving	Other
1	1	29	0	13	13	1	0	1	0	2	1	0	0
	2	44	5	17	22	2	1	0	0	4	0	1	1
	3	32	4	3	7	2	0	0	0	9	0	1	11
	4	38	5	14	19	1	0	0	0	0	0	3	3
	5	51	3	8	11	9	0	0	0	0	0	2	9
	6	74	0	1	1	12	12	1	0	0	0	2	21
	7	69	0	0	0	16	3	1	0	0	1	0	22
	8	40	0	0	0	15	1	2	0	0	0	0	15
	9	56	0	0	0	12	0	3	0	0	0	0	23
	10	60	0	0	0	12	5	1	0	0	0	1	16
	11	42	2	2	4	6	1	0	0	3	0	1	10
	12	50	5	3	8	7	2	0	0	2	0	1	14
	13	69	0	0	0	3	2	0	0	13	0	0	35
	14	39	0	0	0	0	11	0	0	5	0	3	7
	15	58	0	0	0	1	7	0	0	16	0	0	26
Tot.	15	751	24	61	85	99	45	9	0	54	1	15	213
2	1	50	0	12	12	2	3	0	0	0	1	0	10
	2	38	1	2	3	5	2	1	0	0	0	0	11
	3	36	2	11	13	7	0	1	0	0	0	4	3
	4	32	5	6	11	5	3	0	0	0	0	3	2
	5	53	3	0	3	6	4	0	3	0	0	2	8
	6	61	3	3	6	9	2	0	0	0	0	2	19
	7	60	4	2	6	10	4	1	0	0	0	3	16
	8	35	1	1	2	10	4	0	0	0	0	2	8
	9	12	3	1	4	1	0	0	0	0	2	0	2
	10	42	1	1	2	8	4	0	0	0	0	2	13
	11	45	4	4	8	4	5	0	0	2	0	2	11
	12	57	0	0	0	12	0	0	0	13	0	0	14
	13	28	0	0	0	2	6	0	0	4	1	0	9
Tot.	13	549	27	43	70	80	37	3	3	19	4	20	126
3	1	60	0	11	11	2	1	8	0	1	0	1	13
	2	28	0	8	8	2	0	1	0	2	0	0	2
	3	26	1	7	8	0	1	1	2	1	1	0	4
	4	36	5	4	9	6	1	0	0	3	0	3	3
	5	46	4	8	12	7	0	0	0	0	0	0	5
	6	50	2	5	7	12	1	1	0	1	0	3	7
	7	34	1	5	6	1	5	0	0	0	0	0	6
	8	48	0	1	1	5	5	1	0	0	0	0	12
	9	35	2	4	6	3	2	1	1	0	0	0	8
	10	43	2	3	5	0	3	0	2	1	0	2	7
	11	21	--	--	--	Dense		Mature		--	--	--	--
	12	27	3	1	4	0	0	2	3	0	0	1	9
	13	37	1	1	2	7	2	1	1	0	0	1	1
Tot.	13	491	21	58	79	45	21	16	9	9	1	11	77

(continued on following page)

TABLE 1. (continued)

Strip Number	Plot Number	Number Trees Over 4 Inches D.B.H.	DOMINANT AND CODOMINANT TREES									Intermediate Trees		Intermediate Replacements	
			WWP Surviving	WWP Damaged	Total WWP	WL	DF	GF	WH	LPP	Other	WWP Surviving	Other	WWP Surviving	Other
4	1	49	1	11	12	2	1	6	0	0	0	0	13	0	8
	2	33	0	10	10	0	0	9	0	0	1	1	2	0	1
	3	16	0	8	8	0	1	0	0	1	0	1	3	1	1
	4	13	0	8	8	0	0	0	0	1	0	0	0	0	0
	5	37	0	9	9	3	1	1	0	0	0	1	2	1	2
	6	41	2	6	8	6	3	2	0	0	0	1	12	0	2
	7	65	1	2	3	16	1	2	0	0	0	0	23	0	2
	8	47	0	1	1	1	2	3	4	0	4	0	12	0	1
	9	53	3	3	6	8	2	4	0	0	0	2	10	0	3
	10	48	1	2	3	6	0	3	0	1	0	4	12	1	2
	11	33	3	0	3	14	1	0	0	1	0	3	6	0	0
	12	34	2	2	4	8	1	0	0	0	0	3	7	1	1
	13	32	2	3	5	9	1	0	0	0	0	3	6	1	1
Tot.	13	501	15	65	80	73	14	30	4	4	5	19	108	5	24
Grand Tot.	54	2292	87	227	314	297	117	58	16	86	11	65	533		
Per Acre Av.	--	424.4	16.1	42.0	58.1	55.0	21.7	10.7	3.0	15.9	2.0	12.0	98.7	3.8	18.5

Blister rust infection and damage to white pine crop trees is severe, the percentages of infection and damage being about 95 and 70, respectively. Disappearance of the damaged white pine from the stand has only recently started. Older cankers of 1927 to 1937 origin are just beginning to completely girdle trunks and cause top flagging. The annual loss of some three to five per cent of the larger pines is easily overlooked because white pines compose only about one-third of the stand. The results of this study indicate that in 10 to 20 years the 70 per cent of the pine crop trees now fatally infected will be lost from the stand.

Twenty years hence stand composition will probably be about as follows:

Surviving dominant and codominant white pine.	16
Surviving intermediate white pines which have replaced damaged dominant and codominant white pines	4
Dominant and codominant western larches	55
Dominant and codominant Douglas firs	22
Dominant and codominant trees of other species.	31
Intermediate trees of other species which have replaced damaged dominant and codominant white pines	19
Total number of trees per acre	147

It is interesting to note that despite repeated heavy rust infections an estimated 20 white pine crop trees per acre will remain on the area 20 years hence. Infection is still occurring within the area, however, and though very few ribes remained in 1941, pine infection took place in that year. The new infection has apparently spread with the prevailing southwest winds from unworked areas in the head of Cat's Spur Creek, near Anthony Peak (Sections 21 and 22), and from the few scattered but heavily infected ribes remaining on Section 10.

White pine heights are increasing from 2½ to 3 feet per year, diameters about 0.25 inches per year. Should annual losses in

white pine crop trees approach or exceed the amount of five per cent, white pine volume additions will continue to exceed volume losses due to blister rust for only about ten years.

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